NOVEMBER/DECEMBER 2024

DPH12/GPH12 — CLASSICAL AND STATISTICAL MECHANICS

Time : Three hours Maximum : 75 marks

Shanmuga Industries Arts & Science College T.V.Malai

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Define cyclic coordinates.

2. Compare Lagrangian formalism and Hamiltonian formalism.

3. What is the advantage of using action-angle variable?

4. What are three modes of linear harmonic oscillator?

5. Define moment of inertia tensor.

6. Write down the equations of torque free motion of a rigid body.

7. Define thermodymaic potential.

8. What is phase space?

9. What do you mean by Fermi-Dirac distribution?

10. Define ideal gas.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) List out the properties of Poisson's brackets.

Or

(b) Apply Hamilton's equations of motion to solve linear harmonic osciallator problem.

12. (a) Derive Hamilton – Jacobi equation.

Or

(b) Using the theory of small oscillations. Discuss forced harmonic oscillator problem.

13. (a) Write a note on precession and nutation.

Or

(b) Define angular momentum and find the kinetic energy of a rotating body.

14. (a) What is meant by an ensemble? Classify ensembles and explain them briefly.

Or

(b) Write a note on first and second order phase transition.

15. (a) Briefly discuss about thermionic emission.

Or

(b) Differentiate between Fermi – Dirac and Bose – Einstein statistics.

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SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Explain D'Alembert's principle. Derive Euler – lagrangian equation from D'Alembert's principle.

17. Use action angle variables to solve Kepler's problem.

18. Based on Euler's equation, discuss the motion of a symmetrical top under the action of gravity.

19. What is partition function? Establish relation between partition function and its thermo dynamical properties.

20. Derive Planck's law of radiation and discuss its limitation.

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